

Joslin (B. F.)

A

DISCOURSE

ON THE

PRIVILEGES AND DUTIES OF MAN

AS A

PROGRESSIVE BEING,

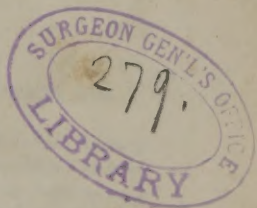
DELIVERED BEFORE

THE NEW-YORK ALPHA

OF THE

Phi Beta Kappa Society,

JULY 23, 1833.



By BENJAMIN F. JOSLIN, M. D.

PROFESSOR OF NATURAL PHILOSOPHY IN UNION COLLEGE.

SCHENECTADY:

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1833.

At a meeting of the New-York Alpha of the Phi Beta Kappa Society, held July 24, 1833—it was

On motion, *Resolved*, That the thanks of this Alpha be presented to Prof. JOSLIN, for his Discourse delivered yesterday, and that he be requested to furnish a copy for publication.

Resolved, That the Hon. John W. Taylor, Rev. Dr. McMaster and Prof. Potter, be a committee to communicate to Prof. JOSLIN the above vote.

ATTEST.

C. AVERILL, *Cor. Sec'y.*

PROF. JOSLIN,

Dear Sir,

WE take pleasure in communicating the enclosed resolution, and beg leave to express, individually, our desire that you may find it convenient to comply with the request of the Society.

Very respectfully,

Yours, &c.

J. W. TAYLOR, }
G. McMASTER, } *Committee.*
A. POTTER, }

UNION COLLEGE, July 25, 1833.

UNION COLLEGE, July 26, 1833.

Gentlemen,

YOUR note transmitting a resolution of the *New-York Alpha of the Phi Beta Kappa Society*, afforded me much pleasure. With grateful acknowledgments for the favorable manner in which the Address was received by the Society, and for the kindness with which its resolution has been communicated by the committee, I present a copy.

I am, gentlemen,

With great respect and attachment,

Your ob't. and humble serv't.

B. F. JOSLIN.

Hon. J. W. TAYLOR,
Rev. Dr. G. McMASTER,
Prof. A. POTTER.

DISCOURSE.

MR. PRESIDENT, AND GENTLEMEN OF THE SOCIETY—

THE noblest object of history, is to exhibit the progress of the human mind; to record those events and trace the operation of those causes which have the strongest bearing upon the moral and intellectual attainments of the human race. These are not the battles that have been fought, the victories achieved, the defeats sustained, the elevation of one monarch, or the degradation of another; though the historian would teach us to regard the record of such events as the history of man, of all that is great and glorious in his conduct, character and destiny.

This learned society, which enrolls among its members men who have contributed in no small degree to carry forward the sciences and arts, need scarcely be reminded by me, that the great epochs of human improvement, are not those which occupy the most conspicuous place on the pages of that, which, by way of eminence, is called history.—Would the history of England have mentioned the name of Bacon, if he had not held a civil office? But was this his most useful or exalted function? was it this which rendered him the benefactor of all succeeding ages, and stamped his name with immortality? Compared with what the

author of the *Novum Organum* achieved, by systematizing and rendering universal that inductive method, which had before been but occasionally, partially, and empirically practiced, these official acts of Bacon are insignificant in relation to the great interests of the human race.

Every real contribution to human knowledge makes an indelible impress on the condition of man; it affects future and distant ages; and when many events which strongly excite the public mind, but which are transient in their consequences, shall have been forgotten, the great benefactors of science will be remembered. When heroic but ill-fated Poland was engaged in her last sanguinary and unequal conflict; when her own critical situation might be supposed to have created an all-absorbing interest, she nevertheless forgot not the great concerns of the human intellect, nor her own Copernicus, that

“Son of earth, to whom the power was given
To measure the mysterious march of heaven.”

A statue erected to his memory in Warsaw, was then, after ten years' labor, completed and unveiled to the public.—The enthusiasm excited in that generous people by this exhibition, evinces a heroism not surpassed by them in the field of battle, and at the same time attests the moral grandeur of the progress of science. The inhabitants of that devoted city, assembled around the monument, were addressed by one of their aged fellow-citizens. He said that “three centuries had passed since Copernicus had been gathered to the bosom of that earth, whose motion round the central sun he had revealed. That the forgetfulness of the great services of the great, was usually succeeded by the outbursts of grateful remembrance, and that posterity often dragged forth to immortal memory the names which had been resting in temporary oblivion. Now, said he, after ten years’

lingerings, shall every Polish heart vibrate with the satisfaction that beams from every Polish eye, and the sun on which Copernicus turned in perpetual gazing, shall for the first time visit his image with its glorious beams." My brethren, in fallen Warsaw those glorious beams still illuminate that cherished image ; but they no longer gladden the hearts of a free people. The discoveries of Copernicus are still operative in guiding the contemplations and researches of man ; but where is the fruit of the sacrifices of Skrzynnecki ? Alas ! The influence of his brave and generous example is all that remains.

If we cast our eyes over the map of the civilized world, and view the degree of civil and religious liberty enjoyed, we shall not invariably, perhaps not generally, have the satisfaction of perceiving, from the comparison of two consecutive centuries, any progressive amelioration. In the modern history of some countries, and especially our own, there is much to justify pleasing reflections on the past and sanguine hopes for the future. But are these hopes to be founded chiefly and primarily on the effect of salutary political institutions, and not rather on the influence which an advanced and progressive condition of society exerts in the attainment and preservation of these institutions ? If man be the *passive recipient* of freedom, it may flow out as it flowed in ; what is merely achieved *for* him by a hero may be snatched *from* him by an usurper. Who is not familiar with such examples ? And what philanthropist has not sickened at the sight, and anxiously inquired for some permanent improvement in the condition of his race ; for some good which is stable, or some attainment which is progressive ; some polar star whose mutations are slight, or some sun which is for ever advancing.

Science affords such an object ; sometimes nearly stationary, generally progressive. *The progress of the human*

mind, presents the most grand and interesting feature in the annals of our race; and though suffering occasional interruptions and retardations, is far more constant than those extrinsic circumstances to which, from the vicious manner in which history has been written, our attention is too often confined.

I would invite your attention to THE PRIVILEGES AND DUTIES OF MAN CONSIDERED AS A PROGRESSIVE BEING.

I shall not here attempt to estimate the great moral and intellectual influences of christianity, that most important of all sciences, which was neither founded by human wisdom, nor improved by human research, but revealed perfect from Heaven.

If we consider only man's intellectual attainments, by means of discovery and invention in the sciences and arts, we shall find that, at least in modern times, no subject of history presents fewer retrograde movements, or stationary positions. Something has been lost, but much more gained. Some fields have been for a time neglected, but others were cultivated. The grand discoveries are distant, but intermediate ones preserve a continuity. The rays of the sun of science are not like the coruscations of a meteor; brilliant, transient and rare, breaking forth after long intervals of total darkness, with a momentary splendor. In taking a distant view of the progress of those branches of knowledge, with whose history we are but imperfectly acquainted, we discern only the brilliant epochs, and those discoveries which gain popular celebrity, either by their simplicity and grandeur, or their direct and obvious utility. The discovery of the circulation of the blood, the most important ever made in physiology, has justly immortalized the name of Harvey. The preparations made for it before his time, and the additions made to it since, will not be so generally known.

The vague conjectures of Hippocrates, the incomplete though real discovery of Servetus, and the triumphant demonstration of Harvey, succeeded each other at long intervals ; but during these intervals, and especially the last, facts were accumulating which had a bearing on the discovery, to say nothing of the more rapid progress made in other fields of research. But even in our own times, when the continuity of this progress is more complete, it is not till we are roused by some great discovery, that we learn that numerous experimenters, observers and theorists in different regions of the globe, had been collecting the materials and arranging them by laws of subordinate generality, till, from the advanced state of the science, or the genius of a superior mind, which detects some analogy or coincidence not previously observed, a grand law is developed, which renders generally accessible a mass of knowledge that had been chiefly confined to the indefatigable student of a particular department. Since the revival of learning, scarcely a day has passed without the discovery of some object, or phenomenon, or principle ; the measurement of some natural phenomena of which the knowledge was vague, or the detection of some analogy among those which were isolated ; thus laying a foundation for exact knowledge and the discovery of general laws. There is little to excite admiration or wonder, whilst these contributions are gradual, and the stream of improvement, insensibly widening and deepening, is flowing gently along ; but only when suddenly augmented it swells to an unusual height, or bursts from its accustomed channel.

In most of the sciences, especially those which exhibit the results of observation, experiment and reasoning, directed to the investigation of the objects and phenomena of nature, there is a store of recorded knowledge, which for ages

past has been accumulating, but to which more has been added during the last three centuries than during the two thousand years that preceded them. This constitutes the scientific wealth of the world; not the hoarded treasure of the few, gained by impoverishing the many, but a common stock, accumulated by the labors of men who enrich others in proportion as they enrich themselves. This wealth is not gained by simple transfer from one possessor to another, but produced by a species of creation, dug up from the mine of undiscovered truth, where unnoticed and unproductive, it had lain buried from the beginning of time. This common stock of knowledge, this intellectual wealth of the world, is so classified and arranged that every portion of it becomes attainable by any succeeding age, its general principles and chief results, by any single individual, and the benefits resulting from its practical application, by whole communities. By this process, the sciences which determine the intellectual stature of this collective race, and the arts which constitute its physical power, are constantly maturing, and the human race as an individual, is elevating itself in the scale of being, is growing up from infancy to youth, and from youth is ripening into maturity.

By representing the world as an individual advancing from infancy to manhood, we claim no superior talent for the present age, nor give any just ground of offence to the admirers of ancient genius. Science is certainly indebted to the Greeks; yet, in its present advanced state, we resort to their writings, not chiefly as the storehouses of science, but as the consecrated fountains of taste. We resort to them for language and sentiment and the principles of human action, but not the laws of nature. There are certain provinces of thought, in which the point of maximum attainment may be nearly reached by the unaided efforts of a single powerful mind. There are certain arts, in which per-

fection depends on the experience and genius of the individual, rather than on the maturity of the race. Such are oratory, poetry, painting and sculpture. In these, if an individual excels, he excels for himself; his skill is not transferable and cumulative in the same degree as the results of scientific investigation, or the inventions of the mechanical and chemical arts. The rules of taste are not susceptible of indefinite improvement. It is, therefore, not surprising that those learned writers who have considered man chiefly in this relation, should be prone to view him as stationary, oscillating or retrograde.

But considered in his relation to the sciences, his destiny presents a spectacle more cheering. 'The gift of speech laid a foundation for tradition, by which many of the attainments of an age survived it, and became the basis of the original discoveries and inventions of succeeding generations. Among these inventions, that of writing served to perpetuate others, and without it the advancement of man must have been slow and limited. But the art of printing is that, which above all others has secured a continued progression. This one step has secured every other. Before this, he was like a traveller ascending a slippery mountain, his progress not only slow, but precarious. A beneficent providence, however, has at length conducted him to a point, from which relapse is morally impossible. This reflection affords a stimulus which it was not the privilege of the ancients to enjoy. For we live in an era, in which we see that no portion of the treasures of science is destroyed, and know that none is liable to destruction. The intellectual riches of the world are not like those which may "take to themselves wings." A volume consumed by fanatics or barbarians, is like one of the heads of the fabled hydra, the loss of which, instead of destroying the existence of the whole, was repaired by the vitality of the surviving body.

Shall the conflagration of any Alexandrian library, consume the edifice of science ? It is imperishable ; and its imperishable character is what gives value to the smallest contribution made to this stupendous structure, and confers dignity on the humblest artizan employed upon its walls. The man who adds one stone is not laboring for a single country or a single age, but for the whole civilized world and for all future generations. The stone which he adds is to be built upon ; his labors are to guide the labors of others ; he is a fellow worker not only with the ancient and venerated founders, but with the architects of future times who shall engage in the same glorious work, and carry it forward to perfection.

Much of the dignity and value of scientific pursuits, depend upon this co-operation of distant ages and nations in promoting the progress of the human mind. To enumerate every instance of this co-operation would be to give a history of the sciences. It is well exemplified in the history of Astronomy, which presents the longest series of recorded observations. This series, commencing in regions where the contemplation of the heavenly bodies was invited by the serenity of the sky, and at a time when it was encouraged by the superstition of the age, is still carried forward in every enlightened nation, long after the superstitious incitements of astrology have been annihilated by those very labors which so long had cherished them.

To astronomy, even the middle ages were not one continued night. What was known at the time of Ptolemy has been preserved in his *Almagest*, and not only preserved, but considerable additions were made by the Arabians, among whom the light of science was rekindled at a period when Europe was involved in darkness. To them we are indebted not only for the treasures of Grecian medicine and astronomy of which they were the depositaries, but for the

foundation of chemistry, for improvements in the *materia medica* and other medical sciences, and the advancement of astronomy. The modern discovery of the acceleration of the moon depended upon a comparison of observations made at three distant epochs, in the three quarters of the eastern continent, viz. those made at Babylon by the Chaldeans seven hundred years before the Christian era, those made at Cairo by an Arabian astronomer in the tenth century, and others made in Europe since the revival of learning.

It might seem at first view, that a few vague observations of the Chaldeans, recorded in the *Almagest*, could not influence the investigations of a Halley or Laplace; yet such is the fact. They have enabled the former to detect the existence of a secular variation, which till a comparison was made between observations separated by long intervals had not been suspected; whilst the latter has been since induced to investigate the mechanical causes on which this acceleration depends, and by a knowledge of which the length of the mean month may be predicted for hundreds of ages to come, as well as determined for periods anterior to all recorded observations. Thus, whilst the history of Babel and of Babylon afford impressive examples of the vanity of mere physical strength, and the instability of political power, they teach us at the same time the triumph of intellect, and the ever-during value of the smallest contributions to science. The tower commenced on the plains of Shinar did not reach the heavens; yet man has been constantly approaching them by that intellectual edifice whose foundations were partly laid in the same soil. Whilst Babylon, the glory of kingdoms, is fallen and desolate, her "pomp brought down to the grave," and her city uninhabited "from generation to generation," whilst there is not even to be seen on her plains the tent of the Arabian nor the fold of the shepherd; some

of her astronomical observations have survived the desolation of empires, and contributed to the advancement of modern science.

Another example of the effect of the preservation of knowledge, and the co-operation of several individuals in giving ultimate importance to investigations, which at the time may not appear eminently useful, may be seen in the successive and distant steps by which the human mind arrived at the great law of nature. The friends of Tycho Brahe, urged him to the study of the law, and were grieved that he who was born a gentleman should so degrade himself as to become a philosopher. Yet his observations laid a foundation for the grand laws of Kepler, and these, with the geodesic measurements of Picard, enabled Newton to establish the sublime theory of universal gravitation. Thus in different countries and at different times, did the indefatigable observer of the heavenly bodies, the gifted theorist who studied their analogies, and the exact measurer of the earth, co-operate with that immortal mind which traced the analogies that connect the earth and heavens, and discovered that law by which the Supreme Ruler of the universe unites and governs the most distant provinces of his material empire.

Thus, what is left imperfect by an individual may be completed by his successors. The individual is weak, but the race is all-powerful. The individual is ephemeral, but the race is immortal.

But whence the peculiar importance of this permanent and prolific character of the results of scientific investigation? Is it not from its connection with the *progressive improvement of the race*; a feature which constitutes one of the most striking characteristics distinguishing man from the inferior orders of animals?

How would an intelligent being, placed on this planet without any previous knowledge of its various orders of denizens, be able to distinguish the results of reason from those of instinct? Standing for the first time upon the earth, suppose him to discover near his feet a little tumulus, which the laborious and persevering ant is systematically elevating: suppose him now to direct his eyes to a more distant but apparently not dissimilar object, a mound of earth, such as at the commencement of public works in our vicinity, we have seen rising imperceptibly by the labor of man. The busy multitude of human beings engaged in supplying the materials might seem at first like so many ants; they seem to labor with no higher aim, more profound skill, more rapid progress or more complete success. What then distinguishes the engineering of the man from that of the insect? A closer observation might lead to the conclusion that the difference consisted in the employment of instruments. This is not the whole truth. The history of man compared with that of animals, would disclose a more characteristic distinction, and one on which the former chiefly depends. It would be seen that animals are stationary; that the means employed and the ends accomplished by the instinct of the ant, the bee, the spider and the beaver are in all ages the same. Of all the races of beings which inhabit this planet, that of man is alone progressive.

I have considered this progress as a privilege. Is it not also a DUTY? When we reflect on the *original defects* in the intellectual and physical condition of man, and contrast them with the attainments of which he is susceptible, it is impossible to resist the conviction that human improvement forms a part of the plan of the Creator. I infer that it forms a part of the duty of man. For this progressive improvement is not the necessary result of any property inherent in

man's original constitution, nor of the application of an extraneous and irresistible impulse. In these respects, inorganic matter governed by physical laws, organized plants obeying the organic laws, and sentient animals guided by instinct, are more perfect than rational man if disobedient to the law of progression. For the former enjoy the ultimate degree of perfection for which they were destined, that rank in the scale of being in which they have been wisely and immutably fixed by the Creator. If the bee constructs its cells on the same plan that it did five thousand years ago, it is because there can be no plan better adapted to the purposes for which the insect was created. The dictates of instinct being unchangeable, the Creator has made those instincts originally perfect. On the contrary, the condition of man with respect to the arts, is originally imperfect, and designed to be improved by that creative genius with which he has been endowed, and that industrious investigation for which appropriate powers have been bestowed. This dispensation so far from being defective, is adapted to a nobler nature; but whilst it confers higher privileges, it imposes peculiar *obligations*. Man is responsible for his own education in physical science, for the improvement of the infant arts of primeval society, and the creation of new arts for facilitating human intercourse and augmenting physical power. Is man by nature among the slowest, weakest and most defenceless of animals? *It is that* he may employ his reason and inventive genius as ample substitutes for fleetness and strength; for natural weapons and natural clothing; that he may call the elements to his aid and outstrip the horse, that he may arm himself with artificial weapons and defy the tiger, it is that he may institute researches into the organic and physical laws, his own mechanism and that of the external world, and devise means of defending himself against the inclemencies of every climate.

That investigation is a part of the plan of the Creator and of the duty of man, may be also shown from the *constitution of the human mind*, and that of external nature, and from their mutual adaptation. Shall we be told that those principles which prompt to investigation are love of fame and literary ambition, a refined species of selfishness? Such a notion springs from a very limited view of the human mind.

It is true that no man is exempt from self-esteem and love of approbation, sentiments, which though possessed by the inferior animals, yet, when acting in subordination to the higher faculties, are neither degrading to man, nor offensive to God, who has implanted them in his constitution. But the God of nature, to promote the study of his works, has endowed the human mind with certain other faculties and sentiments, which operate as powerful incentives to original research; and whilst they may be below the loftiness of heaven, they are above the baseness which is attributed to earth; on the one hand, they are not alone sufficient to elevate man to the character of an angel, and on the other, they have no tendency to degrade him to a level with a demon. For example, there is a faculty for discovering the relation of cause and effect, and for tracing individual phenomena to general laws, and these to laws of a higher order of generality. There is a love of the beautiful, the grand and the perfect, which delights in improving the works of man, and in discovering the already existing yet hidden excellencies of the works of God, the countless instances of wise and beneficent arrangement in his creation. I may be thought to claim too high a rank for scientific enthusiasm. It is too common with those who speculate on human nature, and still more so with those whose object is to influence it, to regard it as entirely actuated by selfish hopes and fears, as governed and governable chiefly by grovelling passions,

which are fed by the coarser and more palpable aliments, and to forget its susceptibilities of breathing the pure atmosphere of taste, midway between earth and heaven, and of looking around it with delight on the broad expanse of moral grandeur, and the rich and varied tints of moral beauty ; they regard man as impelled by those passions which are guilty in their origin and degrading in their tendency, and overlook that innate love of truth, which marks the divine original of the soul, and that insatiable thirst for knowledge, which is a pledge of its immortality.

Moreover, the constitution of the *material world*, no less than that of the mind, proves that the Creator has designed those investigations which bring the sciences into existence and extend their boundaries. The distinguishing excellence of science depends on generalization. One general law embraces a multitude of facts. The structure of one well-formed animal is identical with that of a whole species, and analogous to that of a whole class. Now, what is the final cause of those striking analogies that pervade the whole creation, and of those general laws under which its phenomena are susceptible of being classed ? Can we suppose them necessary for the Creator ? Were they not chiefly designed for his rational offspring ? The solution of these questions will, if I mistake not, lead us to infer, that nature has been constituted with express reference to laying the foundation of science, and facilitating its advancement. We admit that this constitution extends, as it were to the very surface of nature, that much of it is obvious at first sight, and essential to the supply of our most common wants, and to the attainment of much knowledge which cannot be denominated science. But it also extends to those recondite yet elementary laws, which are discovered only by profound research. Hence the very order of nature proves, that it was designed to be interrogated by man for the discovery of its mysteries ;

mysteries, which after lying hid from the foundation of the world, are at length revealed to human industry. Hence we infer that exertions for creating and advancing the sciences must be agreeable to the Ruler of the universe, and not only compatible with the dignity of a rational, but with the duty of a religious being, of a being who ought to revere the will of God, by whatever species of revelation it may be manifested.

This naturally leads us to consider the duty of investigation as inferred from its *religious tendency*. How unfounded is that objection to investigation, which arises from an apprehension of some good men, that the discovery of general laws, in which all the individual phenomena are included, will impair the cause of piety ; that the discovery of physical causes naturally tends to destroy our faith in final causes and in the efficient cause. It must be apparent to every reflecting mind, that physical causes are not ultimate principles, but proximate modes of action ; they connect complex phenomena with others more elementary, but are not the efficient cause, which is no other than the Deity himself. The progress of science, by continually developing new proofs of divine power, wisdom and benevolence, is conducive to that devotion which is paid to the Supreme Being, whilst “ignorance is the mother of” no “devotion” but that which is false and irrational. There are many sublime truths of scripture, of which we perhaps have a more adequate conception, than those to whom they were more immediately addressed. Thus our internal mechanism, from which natural theology derives so many resistless arguments, proves man to be more “wonderfully made,” than could ever have been conceived from the testimony of consciousness and an external view of the human body. Anatomy and physiology were to be advanced, before this truth could be duly appreciated. Can we doubt, then, that it is the duty

of man, as a religious being, to study the laws of his organization, and search for those contrivances of the Divine Architect, those impresses of his Maker's hand, which have hitherto escaped human observation? In both nature and revelation alike, it is not chiefly by hidden, but by *discovered* mysteries, that God designs to excite the wonder and admiration of rational beings.

There are many who admit that science is not necessarily irreligious in its tendency, who seldom reflect upon its intimate connection with religious duty, who scarcely recognize the book of nature and the book of revelation as communications addressed to us by the same being, and who seem never to have suspected, that both of these volumes alike, were originally written in a style and character that require *interpretation*. As the volume of nature contains communications from God to man, I infer that it was designed to be interpreted. I say interpreted, for though we cannot doubt the testimony of an inspired apostle, that in the infancy of human nature, the existence and power of the Deity might have been seen written on the face of the heavens and the earth, in characters sufficiently legible to leave the Atheist without excuse, yet a still greater part of this communication was in mysterious characters, to be read only by educated man in his state of maturity, when the work of deciphering should be further advanced. An analogous case is presented in the gradual translation of the scriptures into heathen languages. We first translate some important portions of the New Testament. Shall we stop there, because a small fragment may be all that is absolutely essential to the conversion of the world to the first rudiments of Christianity? Until we are prepared to justify this, let us, for the sake of consistency, enforce the duty of a further unfolding of the volume of nature. Let us not be tempted to regard it as a mere selfish and secular employment, uncon-

nected with the great interests of mankind, and unsuited to the serious hours and prejudicial to the spiritual interests of an immortal being. There are times perhaps in the life of every religious man, when this temptation operates as a check upon investigation.

Are any prevented from discharging this duty by the pride of learning, or the luxury of *indolent study*? Instead of regarding study solely as a means of gratifying the pride of extensive attainment, or the appetite for the luxury of knowledge, let us consider one object of study to be, to increase the knowledge, power and happiness of mankind. It is a commendable industry which enables us to appropriate to ourselves the learning of a profound author. But if we have not, in the progress of the perusal, repeatedly paused to inquire, is this truth fully established? and if so, does it afford a clue to no undiscovered truth or suggest no new practical application? we have discharged but half our duty. If such a course were universal, individuals might be more learned, but the race would be stationary.

Are any prevented from regarding investigation as a duty by an impression that most discoveries and inventions are the result of *accident*? This has been exaggerated by the lovers of the marvellous, who delight in effects unconnected with any obvious cause. Such prolific accidents occur chiefly to men of industry, and to minds which are accustomed to trace the relations of cause and effect, to generalize facts, and by patient investigation, to deduce great truths from those familiar phenomena, which present themselves to the most careless observer, and from those simple reflections, which may arise yet remain unfruitful in an ordinary mind. How many in all ages must have seen, in spouting fluids, the *vena contracta*! yet the discovery of it is justly attributed to Newton. How many before Galileo must have watched the oscillations of a suspended lamp,

without perceiving them to be sensibly isochronous ! Many experienced the benefits of vaccine infection, without conceiving, like Jenner, the sublime project of extirpating from the earth, a pestilence more formidable than that which is now extending its ravages on our continent.

Finally, are some of us *discouraged* in our exertions, by the desponding apprehension that the *field is now gleaned* ? that at least no hope remains for those who are not gifted with the talents of some who have just departed, a Young, a Davy, a Wollaston, a Cuvier, or a Spurzheim ? Similar reflections have, no doubt, in all ages, tended to repress the enterprize of the youthful adventurer. But while we revere and lament the fathers of science who “have fallen asleep,” shall “all things remain as they were ?” Such apprehensions are groundless. The removal of the veil from one link of the chain, brings another nearer to view, by disclosing new relations between apparently isolated laws, and between distant branches of knowledge. Every step places man in a position to view nature under a new aspect, and thus facilitates the discovery of new analogies, and leads to new generalizations. Whilst the progress of discovery imposes the necessity of more extensive knowledge, more numerous and exact observations, and more delicate instruments of research, it at the same time furnishes the means. As the empire of science is extended, it acquires new instruments of conquest ; as its circle is enlarged, it affords more numerous points of contact with the vast unknown beyond it.

Those who have cultivated the sciences most successfully, have been far from imagining the field to be exhausted. Newton compared himself to “a child who had been gathering pebbles on the sea-shore, whilst the whole ocean of truth lay undiscovered before him.” Did Newton, then, regard his employments as childish, or their results as trivial ? In

vindicating his just claims to humility, we should impute to him no such sentiment. The pebbles on the shore excited no contempt, but the boundless ocean inspired him with awe and admiration. But did he regard this ocean not only as unsearched, but wholly unsearchable, and human nature as doomed for ever to linger on the same shores and recount the same pebbles? Did he believe that no indefatigable traveler should search more of its coasts, no fortunate navigator discover its distant islands, or no adventurous diver, by some yet untried expedient, explore its coral beds? Already have such discoveries been made in the very rout which he pursued. Some of these, with the prophetic eye of analogy, he saw as through a glass, darkly, whilst others were entirely concealed from his view in the position which he occupied; yet above the horizon of that eminence to which his researches conducted his successors, and within the penetration of those instruments which his genius had devised to aid their intellectual vision.

The revelation of the mysteries of nature diminishes not their number : to dispel the darkness from one subject, is to diffuse a feeble light on others, and to render that a mystery, which till then had never been a subject of contemplation. Whilst the sun of science is advancing in his eternal course, and with his direct beams is chasing away the twilight, the fainter rays of the latter are making the same rapid encroachments on the regions of total darkness.

A view of our attainments is calculated to inspire us with humility and hope. The brightening dawn of truth arouses the enterprize, quickens the activity and sustains the perseverance of her votaries, until, with the humble attainments of this life, they commence another of endless duration, in which the progress of the individual shall be as unlimited as that of the species.

NOTES.

NOTE TO PAGE 9.

"Numerous experimenters, observers and theorists in different regions of the globe, had been collecting the materials, and arranging them by laws of subordinate generality."

The interests of science may suffer by fastidiousness with regard to experiments. Many have admired the dignified pursuit of a purely speculative, but false and barren philosophy, who would have viewed with contempt and disgust, the experimental details which have laid the foundation for an exact knowledge of the sublimest truths. To the view of a superficial observer, how much more agreeable a Plato or an Aristotle, engaged in the purely intellectual employment of speculating, a priori, on the heavens, than a Herschell, with his own hand, polishing mirrors to obtain real knowledge on the same subject, or a Franklin constructing a kite to discover the nature of lightning, or a Newton blowing a soap-bubble to investigate the properties of light! Many admire the results, who would not have respected the means. At a distant view, the grand lineaments of science may strike us with admiration, whilst, on a closer inspection, her minute yet no less essential features may appear coarse and disgusting.

On the other hand, the services of the theorist are not to be depreciated. We may too studiously avoid hypothesis, be too distrustful of analogy, and too apprehensive of a hasty generalization. Much service may be ultimately rendered to science, by proving that certain phenomena are usually associated, or usually appear in a certain order, although it be not an universal fact. The man who announces such a discovery, is not to be stigmatized as a visionary theorist. This is indicating a rout which promises to lead to the discovery of a general law. Another individual may be led to the discovery of the principle which connects the phenomena, or to that on which the analogy or coincidence depends. The great number of facts requisite for establishing a general law, would seldom be collected by observation and experiment, *had not a moderate number of facts previously excited a suspicion of the existence of such a law.* In most mixtures of true and false theory, time with free investigation will eradicate the error, and confirm the truth. The evil, is frequently transient; the good, necessarily enduring. So far as the interests of science are concerned, the errors into which a fondness for analogy had seduced the mind of Kepler, have been of little moment compared with the grand truths which were suggested to him by the same principle. Analogy, though unsafe as a sole guide, is often a valuable pioneer. It indicates the rout in which investigation promises to be rewarded with discovery. But we

should not regard this indication as a discovery completed, and sit down to regale ourselves with the fruits of our imperfect conquest, instead of being animated by it to a more vigorous struggle with the obstacles that still remain. As a kind of feeler to the mind, or an organ of search, analogy gropes through the dark regions of the possible and unknown, and selects those probabilities, which we must expose to the spontaneous light of observation or the concentrated rays of experiment.

NOTE TO PAGE 16.

*"That he may institute researches into the organic and physical laws,
* * * and devise means of defending himself."*

During the last three centuries, in which the arts and sciences have advanced with such unprecedented rapidity, the average duration of human life, in the most highly civilized countries, has been nearly doubled. This proves that as society is advancing, the condition of man is becoming more conformable to the natural laws.

NOTE TO PAGE 17.

*"There is a faculty for discovering the relation of cause and effect. * * *
There is a love of the beautiful, the grand and the perfect."*

Whether, with the phrenologist, we consider these as primary and distinct faculties, having specific functions, or regard them as modifications of faculties generally admitted by metaphysicians, in either case, as we admit the existence of intellectual faculties and moral sentiments so exalted and refined, and so conducive to the improvement of the sciences and arts, we derive an argument in favor of discovery and invention, as part of the original plan of the Creator, and of the duty of his rational creatures.

NOTE TO PAGE 22.

"New relations between apparently isolated laws, and between distant branches of knowledge."

As an example of the effect of the advancement of science in furnishing more delicate instruments of research, and disclosing new relations between distant branches of knowledge, we may mention, that discoveries in electro-magnetism have recently suggested an extremely delicate thermoscope, by means of which, the relation that, in the higher classes of animals is known to exist, between *animal heat*, and the quantity of *oxygen* consumed and of *carbonic acid* produced during *respiration*, is proved to exist even in insects.

It may not be uninteresting, at this time, to add, that the dependence of animal heat and the florid color of the blood on respiration, considered in connexion with the fact, that in *epidemic cholera* no pathological phenomena are more constant than a dark color of the blood, and a temperature below the healthy standard, may possibly afford some useful hints in relation to the pathology and prevention of this disease.

Those agents, which have been proved by the experiments of chemists and physiologists, to diminish the quantity of carbonic acid produced by respiration, are also among the most prominent of those, which the experience of mankind in every quarter of the globe, has found to predispose to *epidemic cholera*. These experiments on respiration were made without any reference to this question, and may serve to illustrate the connexion between different branches of knowledge.

Priestly discovered, that different animals of the same species, produced different effects upon the air, according to their constitution. Others have since more particularly examined the subject, and ascertained many additional facts, in relation to those states of the system and those of the air, which promote the oxygenation or decarbonization of the blood. Crawford discovered the influence of temperature. His experiments and those of others have satisfactorily shown, that the quantity of oxygen consumed and of carbonic acid produced, is less, as the temperature of the air is more elevated. All who have experimented on the subject, except Dr. Prout, have detected this influence of temperature. Crawford found that a Guinea pig, confined in air at the temperature of 55 deg. Fah. consumed double the quantity of oxygen which it did in air at 104 deg. In the case of human respiration, Lavoisier and Seguin ascertained that the quantity at 57 deg. is to that at 82 deg. as 1344 is to 1210. Delaroche, in his last series of experiments, made the average ratio about as 6 to 5, at the temperatures tried by him. He found, that by the elevation of temperature, the carbonic acid was diminished, and the absorption of oxygen diminished in a still higher ratio. Still more recently, Dr. John Edwards has examined the effects of different seasons on the decarbonizing process, and found that the long-continued actions of heat and cold, affect the respiration as a vital function; the oxygen consumed being less in summer, even when the air, in which the animal is confined at the time, is of the same density and temperature. Moreover, from the experiments above related, respecting the influence of sudden changes of temperature, as well as from the known effect of temperature on the density of the air, it is evident that its physical changes between winter and summer, must be such, as to make its immediate influence conspire with its gradual physiological effects, and render the consumption in winter and summer still more disproportionate.—Now, no etiological fact is better established, than the influence of heat as a predisposing cause of cholera. The epidemic of 1817, which has since been spreading over the globe, commenced in summer in the hot climate of Hindostan; it has generally, in all climates, been much checked, if not extinguished, by winter. In Russia, the southern regions were those where it spread most widely and rapidly; and those towns which it entered at the end of autumn suffered but slightly. The influence of temperature, has, thus far, been confirmed

by its progress on the Western continent, which, at one time, it threatened soon to overrun. Until the autumnal cold, nothing impeded its rapid march, or changed its malignant character : and both were restored by the heat of the ensuing spring.

Again, Dr. Prout ascertained, by direct experiment, that the quantity of carbonic acid produced during respiration, is diminished by long-continued and violent exercise ; by fasting ; by the depressing passions ; and by ardent spirits, or alcohol taken into the stomach in any form.— Now, it is well known, that all these are powerful predisposing causes of epidemic cholera. The disease has been favored by the fatiguing marches of armies, and the privations which they have suffered ; by the depressing passions, such as the fear of the disease itself ; and by intemperate habits, and even the moderate use of alcoholic liquors.

In the next place, it has been ascertained that the quantity of carbonic acid produced, is less in the night than in the day time. Whether this depends directly on the absence of the sun or not, is not certainly known. But this has no material influence on the value of the fact.— Now, it has been frequently stated, that the attacks of cholera are generally more frequent during the night. At Smyrna, in October 1831, the mortality, it was said, occurred principally in the night. Similar facts have been elsewhere observed.

Finally, Dr. Fyfe proved by experiment, that the quantity of carbonic acid was reduced to *nearly one half* by *vegetable diet*. The corresponding fact in etiology is, that this, in general, is the diet which has predominated in those countries, in those cities and in those classes of society, in which the disease has been most fatal, whether in Asia, Europe or America. That it was mode of living, and not idiosyncrasy, that rendered the Hindoos more liable to the disease than the English residents, may be argued from the fact, that the native soldiers, whose mode of living was more similar to that of the English, enjoyed a similar immunity. Indeed, it was every where observed, that those who subsisted on vegetable food were selected as the first victims.

As the most important effects of respiration, such as animal heat and the arterialization of the blood, depend chiefly upon the introduction of oxygen, and the removal of a nearly equal quantity of carbonic acid, and as the coldness of the body and the super-venous state of the blood, are among the most remarkable phenomena of epidemic cholera, the correspondence between the two classes of facts above noticed, are naturally calculated to suggest many interesting pathological reflections, which cannot, with propriety, be introduced into the present note.